DERMAL UPTAKE OF CONTAMINANTS IN TAP WATER—NEW MEASUREMENTS AND THEIR IMPACT ON MODEL PRECISION

G.A. Keating, T.E. McKone, A. Naik, and R. H. Guy; Lawrence Livermore National Laboratory, Livermore, California and University of California, San Francisco, California

Estimates of dermal uptake of chemicals from drinking water by humans are derived from (typically) *in vitro* and steady-state experiments, which may significantly under-estimate the amount of chemical taken up into the body during short exposure times. In this research we employed novel methods for short-term, low-dose dermal uptake measurements. First we describe an *in-vitro* method based on accelerator mass spectrometry (AMS)—capable of measuring ^{14}C at the femtomole level—that was developed to measure dermal uptake of chloroform (CF) and trichloroethylene (TCE) from dilute solutions (≈ 5 μg/L). This method was used to quantify the amount of CF and TCE taken up into human skin following dermal exposures ranging from 1 to 60 min. Next, we measured the dermal uptake of a series of substituted phenols with two independent but complementary procedures. Saturated aqueous solutions of phenol, nitrophenol and cyanophenol, spiked with 10 nCi of ^{14}C-radiolabel, were applied under occlusion to the ventral forearms of human volunteers for 5, 15, and 60 min. After removal of the delivery system, multiple and sequential infra-red (IR) spectra and adhesive tape strippings of the stratum corneum (SC) were obtained. Samples of the tape strips were analyzed by AMS, while *in vivo* IR spectra provided an alternative assay of the distribution of chemical as a function of depth in the SC. Results from the AMS tape strip analysis show good correlation with the spectral measurement of chemical penetration observed with the IR. These results are being used to assess the reliability of models used to estimate chemical uptake from water used for bathing, showering, and swimming.

Work performed in part under the auspices of the U.S. Department of Energy through Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.